CLAIMS

1. A metal flow device for high pressure die casting of alloys, using a machine having, or operable to provide, a pressurised source of molten alloy and a mould defining at least one die cavity, wherein the device defines a metal flow path by which alloy received from the pressurised source is able to flow into the die cavity, wherein:

(c) a first part of the length of the flow path includes or comprises a runner; and

(d) a second part of the length of the flow path from an outlet end of the runner includes a flow-path exit module (FEM); and

wherein the FEM has a form which controls the alloy flow whereby the alloy flow velocity decreases progressively from the level at the outlet end of the runner whereby, at a location at which the flow path communicates with the die cavity, the alloy flow velocity is at a level significantly below the level at the outlet end of the runner and such that, on filling of the die cavity, the alloy is able to undergo solidification in the die cavity and back along the flow path towards the runner.

2. The device of claim 1, wherein the runner has a cross-sectional area at least at its outlet end such that, at an alloy mass flow rate able to be generated by the machine, the runner will result in an alloy flow velocity at the outlet end of the runner in excess of about 60 m/s up to about 180 m/s for a magnesium alloy and in excess of about 40 m/s up to about 120 m/s for alloys other than magnesium alloys.

3. The device of claim 2, wherein the FEM increases in transverse cross-sectional area in a direction extending beyond the outlet end of the runner, whereby the decrease in alloy flow velocity is able to preclude a change of state of the alloy from a molten state to a semi-solid state exhibiting thixotropic properties.

4. The device of claim 2, wherein the increase in cross-sectional area is such that the decrease in the flow velocity is able to prevent the alloy from undergoing a change of state to enable die cavity fill by molten alloy.

5. The device of claim 3, wherein the increase in cross-sectional area is such that said alloy is able to attain a solids content of less than 25 wt%.

6. The device of claim 3, wherein the increase in cross-sectional area is such said alloy is able to attain a solids content of less than about 20 or 22 wt%.

7. The device of claim 3, wherein the increase in cross-sectional area is such that said alloy is able to attain a solids content of less than about 17 wt%.

8. The device of any one of claims 1 to 7, wherein a gate is defined at the outlet end of the flow path which provides a constriction to alloy flow therethrough.

9. The device of any one of claims 1 to 7, wherein a gate is defined at the outlet end of the flow path which is not a constriction to alloy flow therethrough.

10. The device of claim 8 or claim 9, wherein the gate is at the outlet end of the FEM.

11. The device of claim 8 or claim 9, wherein the outlet end of the FEM is spaced from the gate by a secondary runner which has a cross-sectional area at least equal to the cross-sectional area at the outlet end of the FEM.

12. A pressure casting machine for high pressure die casting of alloys, wherein the machine has, or operable to provide, a pressurised source of molten alloy, a mould defining at least one die cavity, and a metal flow device which defines a metal flow path by which alloy received from the pressurised source is able to flow into the die cavity, wherein:

(a) a first part of the length of the flow path includes or comprises a runner; and

(b) a second part of the length of the flow path from an outlet end of the runner includes a flow-path exit module (FEM); and

wherein the FEM has a form which controls the alloy flow whereby the alloy flow velocity decreases progressively from the level at the outlet end of the runner whereby, at a location at which the flow path communicates with the die cavity, the alloy flow velocity is at a level significantly below the level at the outlet end of the runner and such that, on filling of the die cavity, the alloy is able to undergo solidification in the die cavity and back along the flow path towards the runner.

13. The machine of claim 12, wherein the runner has a cross-sectional area at least at its outlet end such that, at an alloy mass flow rate able to be generated by the machine, the runner will result in an alloy flow velocity at the outlet end of the runner in excess of about 60 m/s up to about 180 m/s for a magnesium alloy and in excess of about 40 m/s up to about 120 m/s for alloys other than magnesium alloys.

14. The machine of claim 13, wherein the FEM increases in transverse cross-sectional area in a direction extending beyond the outlet end of the runner, whereby the decrease in alloy flow velocity is able to preclude a change of state of the alloy from a molten state to a semi-solid state exhibiting thixotropic properties.

15. The machine of claim 13, wherein the increase in cross-sectional area is such that the decrease in the flow velocity is able to prevent the alloy from undergoing a change of state to enable die cavity fill by molten alloy.

16. The machine of claim 14, wherein the increase in cross-sectional area is such that said alloy is able to attain a solids content of less than 25 wt%.

17. The machine of claim 14, wherein the increase in cross-sectional area is such said alloy is able to attain a solids content of less than about 20 or 22 wt%.

18. The machine of claim 14, wherein the increase in cross-sectional area is such that said alloy is able to attain a solids content of less than about 17 wt%.

19. A method of producing alloy castings using a high pressure die casting machine having a pressurised source of molten alloy and a mould defining at least one die cavity, in which the alloy flows from the source to the die cavity along a flow path, wherein:

(a) the alloy, in a first part of the flow path, is caused to flow along a runner; and

(b) in a second part of the flow path between the first part and the die cavity and comprising a flow-path exit module (FEM), the alloy flow is controlled whereby the flow velocity progressively decreases from the level at an outlet end of the runner to a flow velocity whereby the flow path communicates with the die cavity which is at a level significantly below the level at the outlet of the runner.

20. The method of claim 19, wherein the runner is provided with a cross-sectional area at least at its outlet end such that, at an alloy mass flow rate able to be generated by the machine, an alloy flow velocity at the outlet end of the runner is in excess of about 60 m/s up to about 180 m/s for a magnesium alloy and in excess of about 40 m/s up to about 120 m/s for alloys other than magnesium alloys.

21. The method of claim 20, wherein the FEM is increased in transverse cross-sectional area in a direction extending beyond the outlet end of the runner, whereby the decrease in alloy flow velocity precludes a change of state of the alloy from a molten state to a semi-solid state exhibiting thixotropic properties.

22. The method of claim 20, wherein the increase in cross-sectional area is such that the decrease in the flow velocity prevents the alloy from undergoing a change of state and die cavity fill is by molten alloy.

23. The method of claim 21, wherein the increase in cross-sectional area is such that said alloy attains a solids content of less than 25 wt%.

24. The method of claim 21, wherein the increase in cross-sectional area is such that said alloy attains a solids content of less than about 20 or 22 wt%.

25. The method of claim 21, wherein the increase in cross-sectional area is such that said alloy attains a solids content of less than about 17 wt%.

26. The method of any one of claims 19 to 25, wherein alloy flow is constricted by a gate defined at the outlet end of the flow path.

27. The method of any one of claims 19 to 25, wherein alloy flow is not constricted by a gate defined at the outlet end of the flow path.